

JPRS 70494

17 January 1978

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

GEOPHYSICS, ASTRONOMY AND SPACE

No. 413

DISTRIBUTION STATEMENT A

Approved for Public Release
Distribution Unlimited

Reproduced From
Best Available Copy

U. S. JOINT PUBLICATIONS RESEARCH SERVICE

20000405 186

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

51

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22151. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Indexes to this report (by keyword, author, personal names, title and series) are available through Bell & Howell, Old Mansfield Road, Wooster, Ohio, 44691.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS 70494	2.	3. Recipient's Accession No.
4. Title and Subtitle USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS - GEOPHYSICS, ASTRONOMY AND SPACE, No. 413		5. Report Date 17 January 1978	
7. Author(s)		6.	
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201		8. Performing Organization Rept. No.	
		10. Project/Task/Work Unit No.	
		11. Contract/Grant No.	
12. Sponsoring Organization Name and Address As above		13. Type of Report & Period Covered	
		14.	
15. Supplementary Notes			
16. Abstracts The report contains abstracts and news items on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial physics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included.			
17. Key Words and Document Analysis. 17a. Descriptors USSR Geophysics Astronomy Astronautics Meteorology Oceanography			
17b. Identifiers/Open-Ended Terms			
17c. COSATI Field/Group 3, 4A, 4B, 8, 22			
18. Availability Statement Unlimited Availability Sold by NTIS Springfield, Virginia 22151		19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 51
		20. Security Class (This Page) UNCLASSIFIED	22. Price PC704

17 January 1978

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

GEOPHYSICS, ASTRONOMY AND SPACE

No. 413

This serial publication contains abstracts of articles and news items from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

Photoduplications of foreign-language sources may be obtained from the Photoduplication Service, Library of Congress, Washington, D. C. 20540. Requests should provide adequate identification both as to the source and the individual article(s) desired.

CONTENTS	PAGE
I. METEOROLOGY.....	1
Abstracts of Scientific Articles.....	1
Development of Atmospheric Processes in Southern Hemisphere.....	1
II. TERRESTRIAL GEOPHYSICS.....	2
News.....	2
Analysis of Carpathian Earthquake.....	2
Abstracts of Scientific Articles.....	6
Temporal-Spatial Distribution of Strong Earthquakes in Caucasus..	6
Digital Instrument for Measuring Earth's Magnetic Field.....	7
Normal Gravity in Space and on Surface of Level Ellipsoid.....	7
Detection of Large Structural Forms from TV Space Photographs....	8

III. UPPER ATMOSPHERE AND SPACE RESEARCH.....	<u>Page</u> 9
News.....	9
TASS Announces Launching of "Kosmos-966".....	9
"Soyuz-26" Docks with "Salyut-6" Station.....	9
Second Working Day on "Salyut-6".....	10
TASS Announces Launching of "Meteor-2" Satellite.....	11
TASS Announces Launching of "Kosmos-967".....	11
"Salyut-6" Flight Continues.....	12
"Salyut-6" Compared to Other "Salyut" Stations.....	12
TASS Announces Launching of "Kosmos-968".....	14
"Salyut-6" Continues in Flight.....	14
Medical Tests Conducted on "Salyut-6".....	15
Micrometeorites Measured by "Salyut-6" Equipment.....	16
TASS Announces Launching of "Kosmos-971".....	16
TASS Announces Launching of "Kosmos-972".....	17
New Year's on "Salyut-6".....	17
TASS Announces Launching of "Kosmos-973".....	17
Flight Trajectory Correction.....	18
Biological Studies on "Salyut-6" Continue.....	19
Announcement of Launching of "Vertikal'-6" Geophysical Rocket.	19
"Salyut-6" Optical and Medical Experimentation Continues.....	20
"Salyut-6" Crew Walks in Space.....	20
Cosmonauts' Circulatory Systems Studied.....	22
Earth Resources Studied from Space.....	22

	<u>Page</u>
Cosmonauts Secure Normal Conditions on "Salyut" Station.....	25
Medical Experiments Aboard "Salyut-6".....	27
First Week of Flight Completed.....	27
Cosmonauts Check Control and Navigation Systems.....	28
Gubarev Reports from Flight Control Center.....	31
Interview with Shatalov and Yeliseyev.....	34
Docking Described from Flight Control Center.....	35
Upper Atmosphere, On-Board Systems Studied.....	38
"Salyut-6" Crew Studies Glaciers.....	39
"Salyut-6" Meteor Sensors.....	40
Abstracts of Scientific Articles.....	42
Vertical Sounding of Ionosphere in Antarctica.....	42
IV. MISCELLANEOUS.....	43
News.....	43
"Mikhail Somov" Begins Cruise to Antarctic.....	43
Abstracts of Scientific Articles.....	43
Detailed Summary of Nineteenth Soviet Antarctic Expedition..	43

I. METEOROLOGY

Abstracts of Scientific Articles

DEVELOPMENT OF ATMOSPHERIC PROCESSES IN SOUTHERN HEMISPHERE

Leningrad INFORMATSIONNYY BYULLETEN' SOVETSKOY ANTARKTICHESKOY EKSPEDITSII
in Russian No 96, 1977 pp 13-23

[Abstract of article by G. B. Savitskiy, Arctic and Antarctic Scientific Research Institute, and V. M. Lessing, Yakutsk Administration of the Hydrometeorological Service, "Some Characteristics of the Development of Atmospheric Processes in the Southern Hemisphere in 1974"]

[Abstract] Synoptic processes in 1974 were characterized by a predominance of a meridional form of atmospheric circulation, which was observed primarily in the cold half of the year, whereas in the relatively warm period the processes of zonal and meridional forms developed approximately identically. Jet streams in the Atlantic sector of the Antarctic Ocean appeared along the shores of Brazil and were displaced primarily in a latitudinal direction, and from the central part of the Pacific Ocean (with a meridional component) -- toward the shores of Antarctica. The article describes the synoptic situation in detail month-by-month. Maps of the surface and H-500 pressure fields for January and June 1974 are given. Table 1 gives the month-by-month frequency of recurrence of meridional and zonal forms of atmospheric circulation in 1974; Table 2 gives the frequency of recurrence of tropospheric jet streams in Antarctica month by-month in 1974. The branches of the jet streams in the southern hemisphere were propagated primarily from the central regions of the Atlantic Ocean to the northeast in the direction of Enderby Land, from Kerguelen Island -- to Wilkes Land, from Western Australia -- to the Balleny Islands, from the eastern part of the Pacific Ocean -- to the shores of South America, and then turning sharply -- to the shores of Antarctica.

[123]

II. TERRESTRIAL GEOPHYSICS

News

ANALYSIS OF CARPATHIAN EARTHQUAKE

Kishinev SOVETSKAYA MOLDAVIYA in Russian 2 Dec 77 p 4

[Unsigned article: "Carpathian Earthquake: Analysis, Conclusions"]

[Text] The earth's crust must not be regarded as something fixed and inert. It is in the process of constant motion and development. However, these changes transpire extremely slowly and therefore it is difficult to make direct observations of this phenomenon.

In the course of the earth's evolution its solid mantle, the crust was formed. On the continents the crust attains a thickness of several tens of kilometers. And despite the fact that for the time being by drilling it is possible to study the structure and composition of the earth only to a depth of about 10 km, modern geological-geophysical methods for research have made it possible to broaden the range of our knowledge. It has been established, for example, that in Moldavia, beneath the unconsolidated sedimentary cover, consisting of clays, limestones, sands, etc. there is a granite layer with a thickness of about 20 km, and deeper there is a basalt layer of approximately the same thickness. Under these strata there are rocks forming the earth's upper mantle, which in contrast to the granites and basalts have some plasticity and mobility.

Active physicochemical processes in the mantle lead to its vertical and horizontal movement, and as a result, enormous masses of crustal rocks lying on the mantle and forming so-called lithospheric plates are brought into movement. In those places where there is a collision of large parts of the lithosphere moving in different directions (similar to ice floes on the water surface) a mountain-forming process occurs. The formation of mountain chains is a prolonged process which lasts for tens and hundreds of millions of years.

During the formation of mountain structures enormous stresses are accumulated in the rocks. These lead to the formation of folds and fractures (faults) in layers of the upper mantle. After some time the developing fractures are "healed."

In solid rocks the formation of faults is accompanied by the release of a great quantity of energy in the form of mechanical oscillations -- seismic waves whose propagation during strong earthquakes is accompanied by an underground roar. Thus, the places where faults are formed are sources of earthquakes and they are usually called foci. The regions where present-day mountain formation occurs are known in geology as alpine. These are the most mobile and seismic regions. Among the alpine mountain structures are the Carpathians, which are situated in the neighborhood of Moldavia.

Particularly high seismic activity is characteristic of the sector known as the Vrancea complex, where the Eastern and Southern Carpathians form a steep curve. Here, in addition to the vertical uplifting of the complex relative to the Carpathian Plain, there is its horizontal thrust along the plane of a deep fault in a southeasterly direction. As a result, foci of strong earthquakes periodically appear and these are manifested irregularly with time. The zone of strong foci occupies a limited space (approximately 80 x 60 km in area and up to 180 km in depth). During the last two centuries alone the Vrancea complex has been a source of strong earthquakes (1802, 1821, 1894, two tremors in the autumn of 1940 and others). The last significant manifestation of seismic activity in the Carpathians was the earthquake of 4 March 1977.

The seismologists and geologists who are working at the Institute of Geophysics and Geology of the Academy of Sciences Moldavian SSR are studying in detail everything which is associated with the focus of this earthquake and its manifestation at the surface. For this purpose instrumental data have been collected and processed on an electronic computer. These data are from numerous seismic stations. Information has been obtained on damage to buildings and on subjective sensations of individuals from almost 23,000 investigated points.

The earthquake of 4 March was not a single isolated event. It occurred against a background of numerous weak tremors which as a rule are registered only by the instrumentation at seismic stations.

The epicenter of this earthquake was situated in the neighborhood of Fokshani (Rumania), that is, at a distance of 200 km from Kishinev, and the focal depth attained 120 km. The length of the fault plane was about 60 km. The fault plane was oriented from northeast to southwest. The activation of the fault occurred in a southwesterly direction with a velocity of 3-3.5 km per second, which makes it possible to estimate the time of "operation" of the focus at about 20 seconds. The amplitude of displacement of the rocks along the fault was from one to several meters.

The energy released at the focus was 7.2 on the Richter scale, which corresponds to 10^{17} J (the maximum possible energy for the Carpathian zone is 7.5). [The Richter scale (or magnitude scale) is used in determining the absolute quantity of energy released at the earthquake focus.] The

maximum earthquake intensity attained 9 units on the MSK-64 scale in the epicentral region. [The MSK-64 scale has 12 units and is used in evaluating the effect of an earthquake at the earth's surface.] A considerable effect of the earthquake was observed over an enormous area. Tremors were observed in the northeast to the cities of Yaroslav and Gor'kiy, in the east to the Black Sea shores of the Caucasus, and in the south to the islands in the Aegean Sea and in the west to the shores of Italy. Such an extensive area of sensed tremors is attributable to two factors: a great energy and a deep focus. The seismic waves generated by it raced around the earth several times.

The earthquake was sensed in the form of two tremors which were separated by a relatively quiet interval of several seconds.

The territory of our republic was subjected to tremors from 7 (locally 8) units in the southwest to 5-6 units in the northern and northeastern parts. At Kishinev the tremors attained 6 and on weak ground -- 7 units. The seismic activity in the focal zone did not cease after the strong tremor. After the earthquake of 4 March for a period of several weeks there were 46 aftershocks whose hypocenters were situated near the main focus. The energy of the overwhelming majority of the aftershocks attained 3-3.5 on the Richter scale but they virtually could not be evaluated on the MSK-64 scale due to the extremely weak manifestation at the surface.

It should be noted that beginning with six scale units an earthquake can inflict considerable damage on buildings and structures if they are built without appropriate seismic-resistance measures. In their time the specialists and geologists of the Academy of Sciences Moldavian SSR have compiled seismic regionalization maps of the territory and its individual cities. These maps have been used as norms for seismic-resistant construction and despite the additional expenditures, for many years in Moldavia construction has been carried out with mandatory allowance for seismicity.

Together with strong oscillations of the soil, during the earthquake of 4 March in Moldavia there was also another geophysical phenomenon which was observed -- a glow in the sky. Such light effects have also been observed earlier; they were once interpreted by churchmen as "a sign of God." However, such a glow is attributable to the appearance of electric charges accompanying the propagation of seismic waves through rocks containing quartz. It is noteworthy that there is also information on changes in the electromagnetic field in the epicentral region prior to the earthquake of 4 March. It is possible that this is associated with a restructuring of the focus and a change in the direction of the axes of mechanical stresses in rocks prior to the appearance of a fracture. This fact can evidently be used in the search for earthquake precursors.

The reader has the right to ask: how is the picture with the prediction of earthquakes? A complete prediction should give answers to three questions: the place where the earthquake will occur; its maximum intensity at individual points; and finally, the precise time.

Science has solved the first two problems and the already mentioned seismic regionalization map is a practical embodiment of such a possibility.

This third problem -- prediction of the time of earthquakes -- for the time being remains unsolved (naturally, we do not take into account coincidences in prediction and guesswork).

At the present time the matter of intermediate- and short-range prediction of the time of occurrence of strong earthquakes is the number-one problem in seismology. It will be solved by the multisided study of the structure of the earth's crust and the seismic regime of focal zones and drawing upon all possible biological criteria for their further use by means of bionics, that is, by simulation of natural receptors by technical means.

There is no question but that the materials from study of the Carpathian earthquake of 4 March 1977 constitute still another step on the path to solution of this problem.

[140]

Abstracts of Scientific Articles

TEMPORAL-SPATIAL DISTRIBUTION OF STRONG EARTHQUAKES IN CAUCASUS

Tbilisi SOOBSHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian Vol 87, No 3, 1977 pp 601-604

[Abstract of article by O. V. Lursmanashvili, Tbilisi State University, "Temporal-Spatial Distribution of Caucasus Earthquakes and the Possibility of an Interrelationship With Plastic Waves"]

[Abstract] According to a hypothesis advanced earlier by the author, the gradient field of mechanical stresses forming in the epicentral zone as a result of an earthquake causes the appearance of slow plastic waves. It is assumed: 1) that earthquakes can excite two kinds of plastic waves -- a compressional-dilatational wave and a shear wave; 2) that the plastic waves carrying deformations with a value exceeding the elastic limit potentially should be capable of facilitating the occurrence of subsequent earthquakes, that is, it can be expected that plastic waves on their propagation path will favor the appearance of earthquakes in all those places where tectonic forces first can accumulate stresses close to critical; 3) that in the case of an interrelationship of earthquakes with plastic waves there should be a definite functional dependence between the interepicentral distance of related earthquakes and the corresponding time interval and in particular, with a constancy of the velocity of plastic waves this dependence should be linear, of the type

$$\Delta = \Delta_0 + CT,$$

where Δ_0 is the epicentral distance to the zone of appearance of plastic waves, C is the velocity of propagation of plastic waves, T is the time interval between related earthquakes. For the purpose of finding the expected influence of plastic waves on the temporal-spatial distribution of earthquakes a study was made of the frequency of recurrence of Caucasus earthquakes during the period 1800-1970. An analysis of the frequency of recurrence of earthquakes during this period indicated that the expected effect is manifested most clearly in the distribution of strong earthquakes with $M \geq 5 \frac{3}{4}$ during the period 1920-1948. It appears that the appearance

of plastic waves, discussed here in detail, occurring in individual periods of time, can become the initiating factor in subsequent earthquakes. These plastic waves should arise at distances of about 130 and 170 km from the earthquake epicenter and be propagated with velocities $C_p = 60$ km/year and $C = 33$ km/year.

[121]

DIGITAL INSTRUMENT FOR MEASURING EARTH'S MAGNETIC FIELD

Tbilisi SOOBSHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian Vol 87, No 3, 1977 pp 593-596

[Abstract of article by O. K. Shoniya, E. I. Khakhutashvili, S. V. Veltauri and M. I. Gulbatashvili, Geophysical Institute Georgian Academy of Sciences, "Digital Instrument for Measuring the Horizontal Component of the Earth's Magnetic Field"]

[Abstract] The physical principles for digital measurement of the H-component of the earth's magnetic field by the minimum method have been set forth by O. K. Shoniya in SOOBSHCHENIYA AN GSSR, 80, No 1, 1975. The unit described here consists of two principal parts: a unit for measuring the modulus of magnetic field strength and a compensating unit. A five-digit quantum T-magnetometer was used for measuring the modulus. This instrument, developed at the Dusheti Geophysical Observatory, is described and methods for its adjustment and testing are given. The key factor in measuring the H-component is the accuracy in orienting the compensating magnetic field on the zenith. This is achieved by use of three adjustment screws which have measuring limbs. The error of the digital H-meter is $\Delta H = \pm 3\gamma$.

[121]

NORMAL GRAVITY IN SPACE AND ON SURFACE OF LEVEL ELLIPSOID

Tbilisi SOOBSHCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian Vol 87, No 3, 1977 pp 605-608

[Abstract of article by K. M. Kartvelishvili, Geophysical Institute, Georgian Academy of Sciences, "Normal Gravity in Space and at the Surface of a Level Ellipsoid"]

[Abstract] The article gives the derivation of formulas for normal potential and gravity both at points in space and on the surface of a normal earth, defined in the form of a level ellipsoid of revolution. In compact form the formula for normal gravity on the surface of a level ellipsoid is written as follows

$$\gamma = \frac{\gamma_e - \delta \sin^2 \varphi}{\sqrt{1 - k \sin^2 \varphi}},$$

A more complete form of this formula is also given.
[121]

DETECTION OF LARGE STRUCTURAL FORMS FROM TV SPACE PHOTOGRAPHS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 9, 1977 pp 14-19

[Abstract of article by L. F. Volchegurskiy and V. G. Pronin, "Aerogeologiya" Scientific-Production Combine, "Possibilities of Detecting Strong Structural Forms Within the Limits of the Russian and Turan Platforms (On the Basis of Interpreted Materials from Television Space Photographs)"]

[Abstract] The materials presented in this paper show that TV space photographs can be used in detecting the principal characteristics of the large geostructures present in the surveyed region. These features include extended fault zones, first-order tectonic elements and individual blocks. This also includes regional annular structures reflecting the initial (lunar) stage in the earth's development. Some of the clearly interpreted lineaments (Main Ural, Emba-Chuy, Moscow-Ustyurt faults) are fragments of transformed faults forming a system of planetary fissuring. The identical appearance of the photoimage in the southern part of the Caspian depression and the northern Ustyurt makes it possible to postulate a continuation of the basement of the East European Platform as far as the Mangyshlak-Central Ustyurt zone of uplifts which is a natural separation of ancient and recent platforms, separating the Northern Ustyurt from the Bukhara Platform.

[122]

III. UPPER ATMOSPHERE AND SPACE RESEARCH

News

TASS ANNOUNCES LAUNCHING OF "KOSMOS-966"

Moscow PRAVDA in Russian 13 Dec 77 p 3

[TASS Report: "'Kosmos-966'"]

[Abstract] The artificial earth satellite "Kosmos-966" was launched in the Soviet Union on 12 December 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.5 minutes;
- apogee, 316 kilometers;
- perigee, 210 kilometers;
- orbital inclination, 65 degrees.

The satellite carries a radio transmitter operating on a frequency of 19.995 MHz.

"SOYUZ-26" DOCKS WITH "SALYUT-6" STATION

Moscow IZVESTIYA in Russian 13 Dec 77 p 1

[TASS Report: "Cosmonauts On Board the 'Salyut-6' Station"]

[Text] On 11 December 1977 at 0602 hours Moscow time the "Soyuz-26" spacecraft docked with the "Salyut-6" station. After cosmonauts Yu. V. Romanenko and G. M. Grechko crossed into the station, the manned scientific station "Salyut-6" began functioning in near-earth orbit.

The "Salyut-6" orbital station is equipped with two docking units. The first docking unit is installed in the transfer compartment of the station and the second on the opposite side, on the assembly bay. The presence of two docking units makes it possible for two spacecraft to service operations on manned stations.

Unlike the "Soyuz-25" craft, which in October of this year approached the station from the transfer compartment side, the "Soyuz-26" spacecraft docked with the station's second docking unit.

The crew's work program includes:

- studies of physical processes and phenomena in space;
- studies of the earth's surface and atmosphere in order to obtain information in the interests of the national economy;
- biomedical studies;
- technical experiments and the testing of the station's on-board systems and equipment.

The flight program also provides for a prophylactic examination, a control check, and testing of the docking unit installed on the transfer compartment.

The crew has begun the flight program on board the "Salyut-6"- "Soyuz-26" complex. Cosmonauts Grechko and Romanenko are in good health. [5]

SECOND WORKING DAY ON "SALYUT-6"

Moscow PRAVDA in Russian 13 Dec 77 p 1

[TASS Report: "'Salyut-6': Flight Continues"]

[Text] During yesterday's flight program, the cosmonauts completed a series of operations to conserve the on-board systems of the "Soyuz-26" transport ship.

The crew of the "Salyut-6" orbital scientific station began its second working day at 0700 hours. After breakfast and a medical check-up, Cosmonauts Romanenko and Grechko began operations to reactivate the station and to check the on-board systems and equipment.

According to reports from the crew and telemetry information, the cosmonauts are in good health. The station's on-board systems are functioning normally. The parameters of the microclimate in the station's compartments are: temperature -- 21 degrees Centigrade; pressure -- 825 mm Hg.

According to today's flight program, the working day on board the "Salyut-6" station will end at 2300 hours Moscow time.

[5]

TASS ANNOUNCES LAUNCHING OF "METEOR-2" SATELLITE

Moscow PRAVDA in Russian 15 Dec 77 p 5

[TASS Report: "Meteor-2"]

[Text] In accordance with the program to develop further the meteorological system with the use of artificial earth satellites, the meteorological satellite "Meteor-2" was launched in the Soviet Union on 14 December 1977.

The "Meteor-2" satellite was inserted into an orbit with the following parameters:

- initial period of revolution, 102.5 minutes;
- apogee, 906 kilometers;
- perigee, 872 kilometers;
- orbital inclination, 81.2 degrees.

Installed on board the satellite are sets of optical-mechanical scanning television equipment to obtain global pictures of cloud cover and the underlying surface in the visible and infrared spectra for storage or for direct transmission and also radiometric equipment for continuous observation of radiation streams penetrating near-earth space.

In addition to the scientific equipment on the satellite there are: a precise electromechanical system to maintain orientation of the satellite toward the earth; an electric power supply system with autonomous orientation and tracking of solar cells on the sun; a radiotelemetry system for transmitting data on the operation of the satellite's auxiliary systems; a radio system for the precise measurement of orbital parameters; and a radio complex for transmitting the scientific information to the earth.

The equipment installed on the satellite is functioning normally.

The command-measurement complex is in control of the satellite. Information received from the artificial earth satellite will be processed and exploited by the USSR Hydrometeorological Center and the State Scientific Research Center for the Study of the Environment and Earth Resources. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-967"

Moscow PRAVDA in Russian 15 Dec 77 p 5

[TASS Report: "'Kosmos-967'"]

[Abstract] The artificial earth satellite "Kosmos-967" was launched in the Soviet Union on 13 December 1977. The satellite was inserted into an orbit with the following parameters:

-- initial period, 105 minutes;
-- apogee, 1,013 kilometers;
-- perigee, 973 kilometers;
-- orbital inclination, 66 degrees. [5]

"SALYUT-6" FLIGHT CONTINUES

Moscow PRAVDA in Russian 15 Dec 77 p 5

[TASS Report: "'Salyut-6'"]

[Text] Flight Control Center. The flight of the manned orbital scientific station "Salyut-6" continues. Today on the station the working day began at 0800 hours. After breakfast and a medical check-up, the crew began to execute the fourth day's flight program.

The reactivation of the station's on-board systems and equipment was continued. The cosmonauts are preparing the scientific apparatus and instruments for forthcoming studies and experiments.

In one of the communication sessions with earth the cosmonauts televised a report from on board the station. Using a color television camera, they showed the interior of the station and described the significance of the individual systems and instruments.

According to medical check-up data and reports from the crew, Comrades Romanenko and Grechko are in good health.

Work in near-earth orbit is continuing. [5]

"SALYUT-6" COMPARED TO OTHER "SALYUT" STATIONS

Moscow PRAVDA in Russian 14 Dec 77 p 3

[Article by A. Pokrovskiy: "Place of Assignment -- Space"]

[Excerpt] The process known as reactivation is underway. Behind this somewhat dull name is hidden a very important and responsible period of preparation for conducting scientific, technical and technological experiments. The volume of work can be judged from these figures: on board the "Soyuz-Salyut" complex there are about 1,500 different devices and assemblies, and the total mass of scientific equipment weighs approximately 1 1/2 tons.

During the flight of "Salyut-6" in an automatic mode many of its devices were in a kind of "travel pack." Consequently, they must be unpacked and put into operation. On the other hand, some of the systems on the "Soyuz-

26" must be conserved. All of this takes place within an area of rather impressive dimensions -- the length of the space complex is greater than 20 meters, the maximum diameter is more than 4 meters, and the total volume is greater than 100 cubic meters. Thus, there is enough work for Yu. Romanenko and G. Grechko these days.

We asked the USSR pilot-cosmonaut Professor K. P. Feoktistov -- one of the creators of the "Salyut" station -- to tell us about the characteristic features of the sixth representative of this family.

"First of all, it must be remembered," said Konstantin Petrovich, "that like any machine the 'Salyut' stations as developments in technology dependent upon the results of previous flights are improved successively in order to increase their possibilities. The major trends in modernization are an increase in the number of experiments and an improvement in the reliability of the station's systems and the crew's comforts. It is difficult to draw the line between them -- one innovation could serve a variety of interests. Therefore, my discussion of them will follow a rather arbitrary order. I think that I will use as a reference point the 'Salyut-4,' on which one of the members of the present team worked."

"Well, on the 'Salyut-6' a second docking unit was installed. It affords the possibility for docking from both sides of the station as well as for the simultaneous mooring of two transport ships. This is important for crew changes, any necessary rescue work, and the delivery of provisions and equipment to the station. As you see, this improves the reliability and the scientific productivity of the 'Salyut' stations at the same time."

"On the present-day station the scientific equipment for conducting research in the field of astrophysics, the study of earth resources and technical and technological experiments was also renovated. The automatic flight system was also improved. And part of the equipment which was once experimental has become permanent. I have in mind, for example, the on-board teletype 'Stroka,' the system for regenerating water from the condensate of the station's atmospheric vapor, and the economical orientation system."

"Several of these innovations affect not only the technical parameters of the station, but also the comforts of the crew. In addition, there is a shower system on board."

G. Grechko wanted to add to what K. P. Feoktistov had said:

"It is very good that on 'Salyut-6' we can sleep and work as if on earth."

"This comfort was made possible thanks to the more extensive participation in the maintenance of communications with 'Salyut-6' of new radiomeasurement facilities, in particular the USSR Academy of Sciences scientific research ships. And now the daily routine in space and at the control center

approximate that in Moscow. And this is of great significance for the improvement of work capability."

"Thus, the efforts of representatives of various fields of specialization increase the effectiveness of space technology and its contribution to the good of science and the national economy." [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-968"

Moscow PRAVDA in Russian 17 Dec 77 p 6

[TASS Report: "'Kosmos-968'"]

[Abstract] The artificial earth satellite "Kosmos-968" was launched in the Soviet Union on 16 December 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 101 minutes;
- apogee, 822 kilometers;
- perigee, 783 kilometers;
- orbital inclination, 74 degrees.

"SALYUT-6" CONTINUES IN FLIGHT

Moscow PRAVDA in Russian 14 Dec 77 p 1

[TASS Report: "The Flight of the 'Salyut-6' Station Continues"]

[Text] Flight Control Center. By 1400 hours Moscow time the orbital scientific station "Salyut-6" had completed 1,188 revolutions around the earth, 34 of them with the crew on board. The trajectory parameters are:

- apogee, 363 kilometers;
- perigee, 337 kilometers;
- period of revolution, 91.4 minutes;
- orbital inclination, 51.6 degrees.

The crew's third day began at 0800 hours and will last until midnight. Adaptation to the conditions of weightlessness is proceeding normally.

After the previous strenuous days, today in accordance with the flight program the crew has been granted a day of active rest. Cosmonauts Grechko and Romanenko will conduct a prophylactic examination and control checks of individual on-board systems and equipment.

According to telemetry information and reports from the crew, the station's on-board systems are functioning normally. The flight of the "Salyut-6" station is continuing. [5]

MEDICAL TESTS CONDUCTED ON "SALYUT-6"

Moscow IZVESTIYA in Russian 18 Dec 77 p 2

[Article by Boris Konovalov: "A Week in Space Orbit"]

[Excerpt] On Friday December 16 the physicians received additional "food" for objective evaluations: they carried out the first day of medical examinations.

"'Taymyr,' this is 'Zarya'," we hear in the next communication session when the "Salyut-6" is flying over the Atlantic Ocean, "at 1054 it is time to begin to spin the pedals."

"We have completed the first minute of rotation," soon reports the "space bicyclist" Romanenko, who is approaching the shores of France.

"Keep on with the exercise some more."

"The commander has already bicycled over France," reports the earth.

"He has begun to breathe more frequently," comments Grechko.

On Friday Romanenko and Grechko began three types of medical investigation which in the future will be repeated so that the physicians will have material for comparison. The bicycle-type ergometer is not only a physical trainer, but also a medical instrument. Using this apparatus the crew during the medical investigation carries out tests with a carefully measured physical load. The cosmonaut spins the pedals with a velocity of 60 rpm for a period of five minutes. The loads are 750 kgm. By means of the "Polinom-2m" instrument it is possible to register and transmit to the earth data on the pulse rate, respiration, arterial pressure, data on the minute volume of circulation, oscillations of the chest cavity due to cardiac contractions, etc.

Using this same "Polinom-2m" an electrocardiogram is registered for each of the cosmonauts from 12 leads, as under terrestrial conditions, in clinics.

The third type of examination which the cosmonauts began is a measurement of the volume of the lower leg. In space, due to the fact that "life is easy" (it is not necessary to overcome terrestrial gravity), there is some decrease in the volume of the so-called antigravitational muscles, especially in the legs. The physicians want to monitor this process. Depending on the data it is possible to recommend some intensity of the physical exercises which the cosmonauts have already begun to perform regularly.

[137]

MICROMETEORITES MEASURED BY "SALYUT-6" EQUIPMENT

Moscow PRAVDA in Russian 20 Dec 77 p 1

[TASS Report: "'Salyut-6': Flight Continues"]

[Text] Flight Control Center. By 1400 hours Moscow time the orbital scientific station "Salyut-6" had completed 1,283 revolutions around the earth, 129 of them with the crew on board. The orbital parameters of the station are as follows:

- apogee, 365 kilometers;
- perigee, 335 kilometers;
- period of revolution, 91.4 minutes;
- orbital inclination, 51.6 degrees.

The working day for Yu. V. Romanenko and G. M. Grechko began at 0800 hours. Today the cosmonauts are continuing the preparation of scientific equipment and technical documentation for carrying out the program of scientific experimentation which was begun on Sunday 18 December. In addition to scientific equipment which requires the direct participation of cosmonauts to operate, there are on board autonomous devices, including equipment to monitor meteor conditions in space surrounding the station. While in operation it recorded the impact of micrometeor particles a fraction of a milligram in mass. The quantity of micrometeorites recorded is consistent with data obtained through ground-based radar observation.

In radio communication sessions the commander and flight engineer reported that all on-board systems are functioning normally and that the crew is in good health.

Work in near-earth orbit continues. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-971"

Moscow PRAVDA in Russian 25 Dec 77 p 2

[TASS Report: "'Kosmos-971'"]

[Abstract] The artificial earth satellite "Kosmos-971" was launched in the Soviet Union on 23 December 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 105 minutes;
- apogee, 1,021 kilometers;
- perigee, 993 kilometers;
- orbital inclination, 83 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-972"

Moscow PRAVDA in Russian 28 Dec 77 p 3

[TASS Report: "'Kosmos-972'"]

[Abstract] The artificial earth satellite "Kosmos-972" was launched in the Soviet Union on 27 December 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 104 minutes;
- apogee, 1,189 kilometers;
- perigee, 722 kilometers;
- orbital inclination, 75.8 degrees.

NEW YEAR'S ON "SALYUT-6"

Moscow PRAVDA in Russian 1 Jan 78 p 1

[TASS Report: "'Salyut-6': Holiday in Orbit"]

[Text] Flight Control Center. On the last day of 1977 the crew of the "Salyut-6" station is completing its third week in near-earth orbit. In the first morning communications session specialists at the Flight Control Center wished cosmonauts Yuriy Romanenko and Georgiy Grechko a Happy New Year.

Today's flight program includes a medical check-up and physical exercise on the bicycle-type ergometer and the treadmill. The cosmonauts will make a television report from orbit and conduct observations of the earth's surface.

The crew of the orbital station met the new year with the inhabitants of Chukotka. The station passed into the "zone" of the new year at 1440 hours Moscow time. At 0000 hours Moscow time on 1 January 1978 the "Salyut-6" will be over the Himalayas.

The station's crew sent their New Year greetings to the Soviet people and to the peoples of our entire planet. Yuriy Romanenko and Georgiy Grechko wished the people of the earth lasting peace and great personal happiness.

[5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-973"

Moscow PRAVDA in Russian 28 December 77 p 3

[TASS Report: "'Kosmos-973'"]

[Abstract] The artificial earth satellite "Kosmos-973" was launched in the Soviet Union on 27 December. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.8 minutes;
- apogee, 348 kilometers;
- perigee, 210 kilometers;
- orbital inclination, 71.4 degrees.

The satellite carries a radio transmitter operating on a frequency of 19.995 MHz.

FLIGHT TRAJECTORY CORRECTION

Moscow PRAVDA in Russian 31 Dec 77 p 1

[TASS Report: "'Salyut-6': Flight Continues"]

[Text] Flight Control Center. By 1200 hours Moscow time the orbital scientific station "Salyut-6" had completed 1,454 revolutions of the earth, 300 of them with the crew on board.

During the second half of yesterday the station's flight trajectory was corrected. The correction was accomplished using the propulsion system of the "Soyuz-26."

The orbital parameters of the "Salyut-6" station at the present time are:

- apogee, 371 kilometers;
- perigee, 334 kilometers;
- period of revolution, 91.3 minutes;
- orbital inclination, 51.6 degrees.

In accordance with the projected flight program, cosmonauts Yuriy Romanenko and Georgiy Grechko are continuing experiments to study the surrounding environment in the interests of science and the national economy. The crew is conducting observations of the earth's surface and its oceans.

In order to determine the dynamics of the station and the amount of stress on its design a "Resonans" experiment was included in the day's program.

During communications sessions the cosmonauts report that the planned program of study and experimentation is being carried out in full.

The station's on-board systems are functioning normally. Romanenko and Grechko are in good health. [5]

BIOLOGICAL STUDIES ON "SALYUT-6" CONTINUE

Moscow PRAVDA in Russian 27 Dec 77 p 1

[TASS Report: "'Salyut-6': Flight According to the Program"]

[Excerpt] Flight Control Center. The flight of cosmonauts Yuriy Romanenko and Georgiy Grechko is continuing in accordance with the planned program.

A continuous regimen of work and rest has been established for the crew of the orbital scientific station. The working day on the station begins at 0800 hours and continues until 2300 hours Moscow time. Such a regimen makes it possible to maintain the good physical condition of the cosmonauts and to preserve a high working capacity throughout the flight.

In accordance with today's flight program, the cosmonauts will conduct a prophylactic review of individual systems and adjust and test the station's auxiliary and scientific equipment.

Biological experiments are continuing. The cosmonauts are observing the development of amphibians on board the station. The dynamics of the growth of *Chlorella* under spaceflight conditions are being studied.

Tests are being conducted on the working capability of a device that monitors the effect of weightlessness on the kinetics of cell division in microorganisms. Using this device the first French-Soviet biological experiment on a manned space vehicle is being conducted.

According to telemetry information, the "Salyut-6" station on-board systems are functioning normally. The cosmonauts are in good health. [5]

ANNOUNCEMENT OF LAUNCHING OF "VERTIKAL'-6" GEOPHYSICAL ROCKET

Moscow PRAVDA in Russian 27 Dec 77 p 4

[TASS Report]

[Text] In accordance with the program of cooperation among the socialist countries in the field of space research and utilization for peaceful purposes, the geophysical rocket "Vertikal'-6" was launched from the European USSR to an altitude of 1,500 km. "Vertikal'-6" will continue complex studies of the earth's atmosphere and ionosphere as well as the interaction of short-wave radiation with the earth's atmosphere. Specialists of Bulgaria, Hungary, the USSR and Czechoslovakia participated in the development and testing of the scientific equipment and in the launching of the rocket.

[An accompanying photograph shows the assembly of the "Vertikal'-6" rocket in the assembly and testing building of the cosmodrome.] [5]

"SALYUT-6" OPTICAL AND MEDICAL EXPERIMENTATION CONTINUES

Moscow PRAVDA in Russian 24 Dec 77 p 1

[TASS Report: "'Salyut-6': Work Proceeds Successfully"]

[Text] Flight Control Center. The flight of the manned orbital scientific station with cosmonauts Yuriy Romanenko and Georgiy Grechko continues. Yesterday the crew completed experiments to determine the influence of the space environment on the optical properties of the viewing window surfaces. The cosmonauts conducted visual observations and photographed the windows for subsequent analysis and calculation of distortions.

After conclusive check tests were made, the autonomous navigation system "Del'ta" became one of the station's standard continuously operating systems. With the aid of this system autonomous control of the on-board radio complex during communications sessions is made possible. In addition, the "Del'ta" system provides the station's crew with vital navigation information.

Today the crew is scheduled to conduct medical experiments. Immediately after the cosmonauts awakened, a study of the function of blood circulation under the conditions of complete rest was conducted.

The influence of spaceflight on various biological objects continues to be studied.

According to telemetry information and reports from the crew, the cosmonauts are in good health. Work in near-earth orbit is progressing successfully. [5]

"SALYUT-6" CREW WALKS IN SPACE

Moscow PRAVDA in Russian 21 Dec 77 p 1

[TASS Report: "In Outer Space"]

[Text] Flight Control Center. In accordance with the flight program of the orbital scientific station "Salyut-6," on 20 December 1977 Cosmonauts Yu. V. Romanenko and G. M. Grechko emerged into outer space.

The major purpose of the emergence was to inspect and monitor the condition of the station's outer components near the transfer compartment and the docking unit located on it as well as to make any necessary repairs. Structural components of the docking unit may have been damaged as a result of deviation from the mode for docking "Soyuz-25" to the station in October of this year.

Preparation for the emergence into outer space was conducted in several stages. In the station's transfer compartment the cosmonauts put on newly designed semirigid spacesuits, checked the functioning of the autonomous life-support regeneration systems, closed the hatch between the transfer and working compartments and conducted full depressurization of the transfer compartment.

At 0036 hours Moscow time the hatch of the docking unit was opened and flight engineer G. M. Grechko emerged into space. Commander Yu. V. Romanenko remained in the depressurized transfer compartment and monitored the flight engineer's work. G. M. Grechko inspected the surface of the station near the transfer compartment and structural components of the docking unit and assessed the condition of electric connectors, sensors, alinement pins, thrusters, latches and sealing surfaces of the docking unit.

During their checking operation, the cosmonauts used special tools for mounting, monitoring and adjustment. The crew confirmed the operational capability of the docking unit and other station components.

The crew worked in both the illuminated and shadow phases of the orbit. As he emerged into space engineer G. M. Grechko used a portable color television camera to transmit a picture of the components of the docking unit and other parts of the station to earth.

When the job was completed, the cosmonauts closed the hatch, repressurized the transfer compartment, took off the spacesuits, opened the internal hatch and passed into the station's main compartment.

Stable communications were maintained while the crew was in outer space and in the depressurized transfer compartment.

During the 1 hour 28 minutes that the crew spent under the difficult conditions of outer space the methods and new structural solutions that make the crew's walk in space possible were checked, and an external inspection of the station and prophylactic and repair operations were carried out.

Yu. V. Romanenko and G. M. Grechko are in good health after their walk in space.

From 0800 to 1600 hours Moscow time the crew of the orbital station will rest. [5]

COSMONAUTS' CIRCULATORY SYSTEMS STUDIED

Moscow IZVESTIYA in Russian 25 Dec 77 p 1

[TASS Report: "'Salyut-6': Flight Continues"]

[Text] Flight Control Center. The second week of the orbital flight of cosmonauts Yuriy Romanenko and Georgiy Grechko has ended.

Most of yesterday's flight program was devoted to medical studies. For the first time during a spaceflight, a complex study of the cosmonauts' circulatory systems was conducted. The studies were carried out using the multipurpose instrument "Polinom-2M," the "Reograf," and the "Beta" with rheograms, ballistocardiograms and other indicators. These experiments make it possible to obtain data on the characteristics of blood redistribution in a cosmonaut and the contractile functions of the heart during various flight phases. The cardiovascular system was also studied using the "Chibis" vacuum suit.

According to medical monitoring data, both members of the crew are in good health. The commander's pulse rate is 65; the flight engineer's is 55. Their blood pressure is 130/65 and 115/55 respectively.

During today's flight program the crew will conduct control checks of individual on-board systems and continue to prepare scientific and photographic equipment for experiments. The cosmonauts are also engaged in physical exercise on the veloergometer.

The working day on the "Salyut-6" station will end at 2300 hours Moscow time. [5]

EARTH RESOURCES STUDIED FROM SPACE

Moscow IZVESTIYA in Russian 25 Dec 77 p 2

[Article by B. Konovalov: "The Earth Through the Eyes of the Cosmonauts"]

[Excerpt] The crew of the "Salyut-6," Yu. Romanenko and G. Grechko, are engaged in a great program of visual observations from orbit developed by specialists of the State Center "Priroda" with allowance for the needs of all interested branches of the national economy and they began preparations for this work long before the flight. At the Cosmonaut Training Center imeni Yu. A. Gagarin all the crews are now attending a theoretical course on "Space Environmental Science." Here, at Zvezdnyy Gorodok, there is a special classroom richly supplied with technical means for exercises with methodologists. Practical exercises for cosmonauts are also organized for cosmonauts aboard aircraft laboratories.

A senior scientific specialist at the State Center "Priroda," Candidate of Technical Sciences V. Sviridov, told us that Georgiy Grechko participated in several aircraft expeditions. From aboard a Tu-134, under the direction of specialists of the State Center "Priroda," he learned to make observations of different characteristic regions in our country: central European USSR, Ukraine, Crimea, Caucasus, Caspian area, Central Asia, mountain systems of the Pamirs and Tien Shan, water areas of the Black Sea, Sea of Azov, Caspian Sea and Aral Sea. In the words of Grechko, who already had a month's experience in observation from orbit, the flights with specialists gave him a great deal and now he will look differently at the earth.

On this flight, as we were told by representatives of the State Center "Priroda," I. Abrosimov, L. Denisov and V. Kozlov, the cosmonauts are to carry out regular observations of the earth's surface for the purpose of detecting interesting geological structures and scrutinizing the waters of the world ocean, where on the basis of the color of the water it is possible to detect, for example, singular "sea pastures," zones rich in zooplankton. Forest fires, dust storms, dense sea fogs and many other phenomena will become the object of attention of cosmonauts. They will register the most interesting natural formations using a hand camera through the windows.

In one of the communication sessions we heard the voice of G. Grechko: "Near the south pole we frequently see noctilucent clouds. They are very beautiful. First they are narrow and bright, then they are blurred into one, two, three layers. During the last flight I did not see noctilucent clouds; now near the south pole they are frequent. It would be good to scan these clouds with all the on-board scientific instrumentation."

Observation of such infrequent phenomena as noctilucent clouds forming at great altitudes is exceedingly interesting. It is not impossible that the cosmonauts will encounter new and unexpected phenomena. For example, on board the "Soyuz-25" V. Kovalenok discovered that a cloud haze can play the role of a magnifying lens and through it, as through a "hand lens," it is possible to make out clearly even individual waves in the ocean.

Of particular interest for science at the present time is those observations which make it possible to refine some global concepts about our planet. For example, through the efforts of scientists throughout the world specialists are now creating, for example, a modern geological map of our planet, a tectonic map and a map of the ice cover. In geology a popular trend is to go from the general to the particular...from global geological patterns to specific explorations of the regions of our country promising for search for different minerals. Here also assistance from orbit is truly invaluable.

In the interests of global geology the cosmonauts can trace the trend of faults and detect those annular structures which still are in many respects a mystery to scientists. For example, it is of interest to trace where

the line of the so-called Cameroon fault in West Africa extends (this was formed by Cameroon volcano and its neighbors). Now some say that it runs to the north, others say that it runs to the northeast, whereas still others say that it runs to the east of Africa. If the cosmonauts clarify this matter, this will be of great importance.

At the request of UNESCO our country is now preparing an atlas of the snow and ice resources of the entire world. Here also assistance is being given by the cosmonauts, especially by observations of inaccessible and poorly studied regions, which will be extremely valuable. In order to evaluate the possibilities of the cosmonauts in this work they will carry out observations of such objects as the volcanoes Kilimanjaro and Kenya. These are highly contrasting features: against the background of the red-yellow-green savanna one can clearly see enormous mountain masses covered with a snow cap. The glaciers of these volcanoes are well studied, there are atlases, and it is possible to compare reality with the data supplied by the cosmonauts.

Regular observations of glaciers from orbit and registry of their "tongues" is of great practical importance. Now the mountains are being intensively exploited and such complex structures and large-scale installations as the Nurekskaya Hydroelectric Power Station are being constructed there. Fluctuating glaciers are capable of blocking mountain valleys and forming lakes whose breakout can result in human loss of life and the destruction of structures. Fluctuating glaciers constitute a serious danger and cosmonauts, discovering them in time, can help in preventing this danger.

Visual observations from space, widely initiated already aboard the first "Salyut" vehicles, are of a "search," an exploratory nature. One of the central problems which cosmonauts must deal with is an evaluation of the possibility of subsequent detailed investigation with the assistance of different instruments of definite phenomena and processes. This is the first step on the long road to knowledge.

Now, for example, many say that the desert is advancing to the south. The cosmonauts can check to see whether it is possible to see clearly the boundary of the desert, to see if automatic cameras are capable of tracing its changes during different seasons of the year.

Routine observations of fires which the cosmonauts have already noted in many places on the planet make it possible to evaluate the scope of the catastrophe and the direction of movement of the fire. In the future, on the basis of these observations, it will be possible to organize automatic systems for a service for preventing and monitoring fires.

Romanenko and Grechko are attempting to trace the consequences of collision of two tankers along the shores of Africa, to see how the petroleum spot will disperse in the ocean and how it will look.

The crew of the "Salyut-6" has a desire to carry out observations which are of personal interest to them. They have asked that they be given the precise coordinates of the plateau in Peru where figures are incised which some people consider to be the landing symbols for extraplanetary spaceships.

"We are sure that this is a legend," says Romanenko, "but it can be checked out."

"After flights cosmonauts are frequently asked," adds G. Grechko, "whether they have seen anything special over the Bermuda triangle, they are asked if they have seen any flying saucers, and other stupid questions are asked. We wish to be prepared for such questions."

Well, the mastery of space has laid to rest much idle conjecture. Guessing is giving way to knowledge. But reality at times is more interesting than the most improbable fantasies.

[147]

COSMONAUTS SECURE NORMAL CONDITIONS ON "SALYUT" STATION

Moscow PRAVDA in Russian 15 Dec 77 p 6

[Article by V. Gubarev: "Listen to the Music!"]

[Excerpt] The Flight Control Center allowed the "Soyuz-6" crew to sleep to 1000 hours, but already at 0700 the cosmonauts called the earth and said that they were ready for work.

"Our condition is considerably improving," reported Yuriy Romanenko, "and we are gradually becoming accustomed to weightlessness..."

We have already told in reports from the Center how on the first day of flight the human body is attacked by weightlessness. The cosmonaut feels ill and he feels oppressed. On Monday the physicians recommended that they not perform sharp movements and that they strive to turn with their entire body. On Tuesday both cosmonauts had already passed through the "peak" of maximum oppression of weightlessness and the process of adaptation to it was accelerated.

After dinner three and a half hours was allocated to the crew to do what they want. But the physicians intervened here also:

"But as few movements as possible..."

"Do you propose that we lay down on the ceiling?" laughed Yuriy.

"Go through the records, there's some good music there," suggested the Center, "and read a little, there's a library aboard... And the recommendations of the doctors are obligatory."

"The crew deserved this day of rest," says the deputy flight director Viktor Dmitriyevich Blagov. "You understand well that earlier, from the launching and up to the present day, Romanenko and Grechko have had to work under a full load. It could not be otherwise. They carried out operations for mothballing the "Soyuz-26" and ensuring normal living conditions aboard the station."

The entire cycle is divided into three stages. First it is necessary that the "Soyuz" be tied into the "Salyut." By "tie-in" is meant more than a link-up of the electrical system. For example, the cosmonauts installed an air line. This is a plastic tube with a fan. They attached it to the wall and passed it through the hatches. Now the "atmosphere" in the ship and station is identical. And this is very important. Incidentally, if the temperatures are different, there's a chance to catch a cold," says Viktor Dmitriyevich smiling.

"The second stage," continues Blagov, "is the taking care of the entire space home. The cosmonauts connected the system for controlling the electric supply. All the fans on the 'Salyut' were started so that there would be no stagnant zones. Now the 'Salyut-6' has finally been transformed from an automatic orbital station into a manned station and the crew can control it. As you see, all this had to be done on the first day of the flight. Naturally, Romanenko and Grechko were in need of rest. And it was provided them. And then the third stage began; the scientific instrumentation was demothballed."

In the Wednesday report the cosmonauts transmitted to the Center:

"We have everything in readiness. Any comments?"

"No. Everything is going in accordance with the program. Fine lads! And now we will transmit news to you..."

Each evening the "Salyut" crew receives information on events in the country and abroad. This includes a brief review of the newspapers in which there are reports on the flight.

[The article is accompanied by a photograph of the scientific research ship "Kosmonavt Yuriy Gagarin" and it is noted that this vessel and the "Kosmonavt Vladimir Komarov" are being used in tracking the flight and in receiving telemetric information from the "Salyut-6" orbital station.]

[135]

MEDICAL EXPERIMENTS ABOARD "SALYUT-6"

Moscow PRAVDA in Russian 17 Dec 77 p 1

[TASS Report: "'Salyut-6': Orbit After Orbit"]

[Text] Flight Control Center. The next working day of the crew of the orbital scientific station "Salyut-6" began at 0800 hours. The major part of the program has been allotted to medical experiments.

The day's program includes a complex examination of measured physical stress on a bicycle-type ergometer. This experiment is being conducted in order to determine and predict the condition and work capability of the cosmonauts' cardiovascular system. Another experiment is the electrocardiograph of both crew members. Clinical monitoring during the examination is made possible with the use of the multipurpose apparatus "POLINOM-2M" and the "REOGRAF."

Also included in the work program is an experiment to study blood redistribution and to evaluate the condition of particular groups of muscles which under spaceflight conditions are under an insignificant amount of stress.

According to medical monitoring data and reports from the crew, the period during which the cosmonauts must adapt to the conditions of weightlessness has almost ended. Comrades Romanenko and Grechko are in good health.

The flight of the "Salyut-6" orbital scientific station is continuing. [5]

FIRST WEEK OF FLIGHT COMPLETED

Moscow PRAVDA in Russian 18 Dec 77 p 1

[TASS Report: "'Salyut-6': Work According to Program"]

[Text] Flight Control Center. Yuriy Romanenko and Georgiy Grechko have completed the first week of work in near-earth space. The reactivation of the main on-board system and a part of the scientific equipment has been accomplished.

During the next working day, the crew is executing a control check of particular on-board systems, instruments and scientific equipment panels.

During one of the morning radio communication sessions, at the request of the cosmonauts, the latest news of national and foreign events was transmitted to the station.

According to medical monitoring, the cosmonauts are in good health. The commander's pulse rate is 65; the flight engineer's is 60. Their blood pressure is 130/70 and 125/65 respectively.

During the orbital station's flight outside the zone of radio contact with Soviet territory, communications with the crew are made possible by the scientific research ships "Kosmonavt Vladislav Volkov" and "Kosmonavt Yuriy Gagarin" in the Atlantic and the "Kosmonavt Vladimir Komarov" in the Mediterranean via the "Molniya" communication satellite.

The "Salyut-6" on-board systems are functioning normally. The planned flight program is being successfully executed. [5]

COSMONAUTS CHECK CONTROL AND NAVIGATION SYSTEMS

Moscow PRAVDA in Russian 16 Dec 77 p 1

[TASS Report: "'Salyut-6': Work in Orbit"]

[Text] Flight Control Center. In accordance with the flight program of the orbital scientific station "Salyut-6," Cosmonauts Yuriy Romanenko and Georgiy Grechko are continuing operations to reactivate the station's on-board systems and equipment. The reactivation of life support and energy source systems, in particular, has already been completed.

A check of the station's control systems in the manual and automatic orientation modes and in the stabilization mode is part of today's flight program. Conducting navigational measurements using the "Delta" navigation system is included in the flight program for the afternoon.

According to telemetry information and reports from the crew, the station's on-board systems are functioning normally. Comrades Romanenko and Grechko are in good health.

The work of the crew of the "Salyut-6" station is proceeding in full accordance with the planned flight program. [5]

COMMENTS ON "SALYUT-6" WEEK IN SPACE

Moscow PRAVDA in Russian 18 Dec 77 p 6

[Article by V. Gubarev: "'Salyut-6': A Week of Flight"]

[Text] Today it is difficult to be surprised by the very fact of the launching of a new ship into space. However, again and again we glance into the characters of the persons involved and their work in orbit and together with them we are excited at those moments when highly complex operations are carried out in space. A reader from Leningrad, I. Gromov, expresses our thoughts and feelings very fully and truly: "I know that each flight into space requires enormous courage. With all my heart I wish the 'Soyuz-26' crew successful work in space. Tell Romanenko and Grechko that all the Soviet people are with them."

No! No one can become accustomed to space launchings!

The French newspaper "Cotidien de Paris" on the first page, alongside portraits of Yu. Romanenko and G. Grechko, carried an article on the primacy of Soviet cosmonautics, this relating the current experiment in circumterrestrial orbit to the 20th anniversary of the first artificial earth satellite. The launching of the "Salyut-6" took place on the eve of the anniversary of our first satellite, and this new experiment became a singular bridge spanning the second and third decades of the space era of mankind.

These days the press of the socialist countries is devoting great attention to cooperation among the member countries of the socialist economic bloc. This applies, in particular, to the extensive and diversified joint program for investigations in the field of space biology and medicine, directly associated with human activity under weightlessness conditions. It is especially timely now, when, as is well known, citizens of Czechoslovakia, Poland, GDR are in training for manned flights. The specialists of the member countries of the socialist economic bloc are today actively participating in studies of the universe and very naturally they are awaiting with impatience the results of scientific investigations planned on the new Soviet orbital station.

The past week has been a singular prologue to the "scientific chapter" of the space expedition. Yuriy Romanenko and Georgiy Grechko have prepared all the apparatus for operation. They have checked the state of the station, which already for three months has been in circumterrestrial orbit. They have performed the necessary technical operations in order to bring the "Salyut-6" from an automatic flight regime into a manned regime and have tested the "Del'ta" autonomous navigation system. It seems like five days have passed but "the great experiment" began only yesterday, when the crew carried out medical experiments. Has too much time been spent on the "preparatory" stage? Only in the recent past a seven-day flight in itself would have been an outstanding event, but today both space technology and the program for each expedition have become so complicated that just so much time must be spent on preliminary operations. And then, the cosmonauts worked "in two work shifts" per day! But now more and more scientists are appearing in the Flight Control Center: their consultations may be required because each day in the program there are many experiments which are carried out "on the orders of" different branches of science

and the national economy.

In particular, this involves fundamental investigations of the universe. A number of instruments on the "Salyut-6" were pointed at the stars and galaxies; precisely in these there are surprising phenomena transpiring which excite the imagination of astrophysicists. An orbital station is an observatory over which there is no atmosphere which so greatly hinders scientists working at the earth's surface. The cosmonauts are also learning to probe the atmosphere of our planet and to survey the earth's surface. These data are necessary for many scientific and economic organizations. It is also necessary to check the condition of the second docking unit on the "Salyut-6"...

A clear implementation of the program, a good "mutual understanding" between the space and the earth, and finally, adaptation to weightlessness, which for Romanenko and Grechko is passing without surprises, these are the things which characterize the work of the present space crew, one of whose members has already been in circumterrestrial orbit.

"Each person experiences flight in his own way. This is a discovery for each person. Like for a child who learns to walk by himself," such is the opinion of Boris Volynov. "On the second flight you note more which is new, but the emotions are a little less. And you caution your comrade as to what awaits him..."

"It was most difficult of all for Yuriy Gagarin," says Aleksey Leonov, "but now we visualize weightlessness on the basis of his reports, but nevertheless it hits unexpectedly. On the second flight you no longer await it, but are simply ready for this encounter..."

On the "Vostok," "Voskhod" and "Soyuz" ships on each flight there were tests of new equipment and solution of new problems involved in penetration into space, but there were also careful studies of the possibility of man's work under conditions so unusual for him. And the more persons who flew, and the more different were their emotions, the easier it was for physicians and biologists to detect fundamental problems associated with the behavior of man in space. The basis of a new science was formed which now has all the data which it needs both for the screening of cosmonauts and for their training for flight, as well as for "predicting" their activity in space.

And today it can be said with assurance that the "center of gravity" in flight has shifted. Without question, monitoring the condition of a cosmonaut is exceedingly important, and it is necessary, but the most important thing is that the cosmonaut has maximum work capability immediately after the command "ready for launching!" In just one day there are the first revolutions, checking of the ship's systems, a series of maneuvers in orbit, docking, transfer into the station... An enormous volume of work! And it is very important if the "emotions are a little less" and if they do not distract the cosmonaut.

Georgiy Grechko, who is very familiar with weightlessness, not only by advice, but also by his calm reaction to painful sensations and oppression and the strong rush of blood to the head, removed emotional stress from his comrade. Stories are no substitute for experience. It is better to be actually exposed to it. The beginning of the expedition is evidence that the choice of the "Salyut-6" crew was made correctly and thoughtfully. Yuriy Romanenko and Georgiy Grechko, scientists and designers, engineers and workers trusted the station created by them and both cosmonauts worked reproachlessly during the past week.

"The Fundamental Directions in Development of the National Economy of the USSR During 1976-1980" states that it is necessary "to continue study and mastery of space, to broaden investigations with the use of space apparatus in study of the earth's natural resources, in meteorology, oceanology, navigation, communications and for other needs of the national economy." Two years of the Tenth Five-Year Plan have elapsed. The program in the document adopted by the 25th Congress of the CPSU has been embodied in the real work carried out by Soviet scientists and specialists. And not only by means of orbital manned stations: research and practical earth satellites are regularly launched into space from cosmodromes. "Kosmos" and "Meteor-2" vehicles were launched during the past week. The new meteorological satellite will observe the formation of the cloud cover of the planet and carry out investigations of the earth's atmosphere. The information is fed to the USSR Hydrometeorological Center and the Center for Study of the Environment and the Earth's Natural Resources. Similar observations are being carried out by the crew of the "Salyut-6." The complexity of the investigations so characteristic of modern science can be clearly traced in this month which is rich in space events.

[136]

GUBAREV REPORTS FROM FLIGHT CONTROL CENTER

Moscow PRAVDA in Russian 13 Dec 77 p 1

[Article by V. Gubarev: "'Work With Us..."]

[Text] The emotions have not yet calmed down. In the gaps between communication sessions the designers and cosmonauts discuss the events of the past night, maneuvers in orbit, the process of approach and docking of the ship and station. This is natural and indeed it was long awaited. But in essence everything which has transpired in space during the 24 hours which have separated the launching of the "Soyuz-26" and the transfer of Yuriy Romanenko and Georgiy Grechko into the station is only a prologue to the enormous amount of work which the cosmonauts must do. And without delay they began to perform "housekeeping" in their space home.

The reveille planned on Monday for the first communication session was not necessary. Yuriy Romanenko and Georgiy Grechko themselves called "Zarya." In the name of the crew the commander thanked everyone at the Control Center who assisted them in successfully beginning the new space expedition.

With respect to the dialogue between the earth and ship, it seems like the conversation between two mathematicians who easily and without strain juggle figures and terms which are not found in any dictionary. This arbitrary language, born of cosmonautics, is very extensive: in a short period of time the Control Center not only receives all the information on the work done in orbit, but also transmits to the ship the program of operations for the future.

"Receive telegram" -- and the next set of figures is transmitted into space. And this means that Yu. Romanenko and G. Grechko must begin demothballing of instrumentation and apparatus for investigating the earth and universe. And there are so many instruments and apparatuses aboard the "Salyut-6" that a mere enumeration of them would take up an entire communication session.

But in general for the crew all this is familiar work. For the time being there has been nothing unusual in this work. Plenty of times during ground training in a model of the "Salyut" Romanenko and Grechko acted precisely in this way...But here there is weightlessness, the very unusual weightlessness which it is impossible to experience on the earth.

Once I heard the following conversation. An elderly male turned to his neighbor:

"The cosmonauts feel fine...Up there they have it like in a sanatorium -- breakfast, lunch and dinner on schedule and rest at the prescribed time..."

No, many do not correctly understand the phrase "the crew feels well," which is transmitted in information reports from the Flight Control Center. The word "good" is by space criteria, not by terrestrial criteria. On the first day of flight weightlessness imposes an enormous weight on the human body.

"The first impression was somewhat strange -- it was as if I was turned over and was lying with my legs upward," recalls G. Titov.

"At the beginning of the flight, I, like other cosmonauts, sensed a rush of blood to the head, which caused some facial flabbiness," says A. Nikolayev. "But this sensation was familiar to us, we already had experienced it on earth when at the cosmodrome we slept with a negative angle of slope of the beds. We also experienced unpleasant sensations when performing different physical exercises associated with a sharp tilting of the torso and head forward and backward."

"During weightlessness human movements become very sharp," adds P. Popovich. "Man is easily 'twisted' in space. This causes a sensation of nausea. It was decided at once to check rigorously any movement of man. Even a turning of the head should be slow and calm. However, we soon decided that it is better to turn the entire body in the necessary direction. Then the smoothness of movements is guaranteed 100%."

All the cosmonauts, ours and American, invariably emphasize: the most difficult days of the flight are the first! Precisely then the human body reacts acutely to an attack of weightlessness, but then he begins to adapt to it. And this is characteristic -- the sensation of "floating" in space is strictly individual. Each person in his own way adapts to weightlessness, some more rapidly than others. It is good that together with Yuriy Romanenko there is a ship's engineer who spent about a month aboard the "Salyut-4."

In September we were together with Georgiy Grechko in Budapest. There a meeting was held together with Comrade Yanosh Kadar. Naturally, he was interested in Grechko, how the cosmonaut was adapting to space conditions.

"There, as on earth," said Georgiy smiling, "the most important medicine is work."

"I absolutely agree with you," said Comrade Kadar in support of the cosmonaut. "Work makes man both courageous and bold and capable of any feat in the name of the Fatherland."

"And work in orbit is sufficient," added Grechko. "Its volume on the first day is enormous. So that you forget about weightlessness."

I recalled this discussion at the time of the next communication contact with the "Salyut-6."

"How do you feel?" said the earth with interest.

"Fine! There is not a single free minute..."

"Possibly you are resting? You have personal time under the program."

"We have a counterproposal for you: we'll work some, if you please, in collaboration with you for these hours and we will add the 'overtime' to our vacation after our return. Agreed?"

Everyone laughed. If people have not lost their sense of humor this means that they are really in good spirits and are coping with their work. Both on earth and in space.

[120]

INTERVIEW WITH SHATALOV AND YELISEYEV

Moscow GOVORIT I POKAZYVAYET MOSKVA in Russian No 51, 19-25 Dec 77 p 3

[Article by Yuriy Fokin: "To Work in Space"]

[Text] We are publishing a television report which was transmitted on 11 December, on the day of the docking of the spaceship "Soyuz-26" with the orbital station "Salyut-6." The conversation was conducted by special correspondent Yuriy Fokin.

CORRESPONDENT: The Flight Control Center has fallen quiet now. There is a break between communication contacts. And this break is the first since we all heard the words here: "Docking has occurred!" Now we have invited to our microphone the training director for Soviet cosmonauts Twice Hero of the Soviet Union Lieutenant General of Aviation Vladimir Aleksandrovich Shatalov.

"Vladimir Aleksandrovich, how do you evaluate the work just done in space?"

SHATALOV: We have just been witnesses of implementation of the docking of the "Soyuz-26" ship and the "Salyut-6" orbital station. Probably each of the cosmonauts who has had the opportunity to experience this joyous and stressed moment in space is mentally with our comrades and is mentally working with them in orbit. Preparation for docking is a complex and prolonged process. Crews practice it in trainers, probably tens and possibly even hundreds of times. They are checking the effectiveness of different operations and so-called nonstandard situations which can arise in flight. Naturally, docking is therefore always an exciting event.

Today's docking, which we observed on TV screens, went off very precisely, I would say, very quietly. All the ship and station systems operated well. It was pleasant to hear the clear reports of the crew on every aspect, every turning of the ship which took place during the approach and docking stages. All the maneuvers of the "Soyuz" ship were observed by us as if we were standing to one side. We saw them by means of the TV camera which was carried in the instrument compartment of the "Salyut-6" station. It is situated in the upper part, not in the very center of the station. Accordingly, it seemed to us that the approach occurred sort of at an angle, whereas in reality the docking occurred at the stipulated time and with an exceptionally high accuracy.

According to the reports of the crew, all the systems of the docking unit operated well. Tightness was ensured and now we are awaiting the permission of the Control Center for the crew to transfer into the "Salyut" orbital station. Now, to be sure, the crew itself is most excited because it will see its new space home, the enormous laboratory in space, which has already made more than a thousand revolutions. Soon it will be prepared for carrying out scientific experiments and investigations.

CORRESPONDENT: Thus, today at 0602 hours Moscow time there was a docking of the "Soyuz-26" spaceship and the "Salyut-6" station. Now on the screen at the Control Center we see the cosmonauts Georgiy Grechko and Yuriy Romanenko. They have carried out a great amount of work and several minutes ago in this hall we heard applause when they reported about their transfer aboard the "Salyut-6" orbital station. Here warm words were spoken in the addresses of those who created the remarkable space complex which has already begun to carry out major work for the welfare of science and progress, for the welfare of the Fatherland!

And now we turn to the flight director Twice Hero of the Soviet Union USSR Flier-Cosmonaut Aleksey Stanislavovich Yeliseyev.

"Aleksey Stanislavovich, were you excited today?"

YELISEYEV: To be sure. Indeed the "Salyut-6" orbital station is a manned station. The most valuable experiments are precisely those which are carried out with the participation of man. And these experiments are dependent on whether or not a crew is aboard, whether there is a docking or not. Naturally, therefore we were excited today while awaiting this very serious moment.

And now the crew is already aboard the station and it has proceeded to work in orbit. The cosmonauts on the station are maintaining communication with us. They are carrying out mothballing of the on-board systems of the transport ship and are carrying out operations for the demothballing of the station, for checking the on-board systems and the scientific instrumentation.

Georgiy Grechko and Yuriy Romanenko are faced with much interesting and complex work in carrying out the flight program. Much more will be said about this later.

CORRESPONDENT: With this we will end our report. Respected readers, we will carry out regular transmissions telling about the implementation of the program for this flight.

[139]

DOCKING DESCRIBED FROM FLIGHT CONTROL CENTER

Moscow PRAVDA in Russian 12 Dec 77 pp 1, 4

[Article by A. Pokrovskiy: "A Meeting Over the Earth"]

[Text] First it was similar to a large star. The characteristic contours of the "Soyuz-26" ship are still made out with difficulty. But gradually one can clearly see the widely spread elements of the antennas and then the docking unit of the "Soyuz" is moving directly toward us. The sensation is

as if we were not on the solid earth, at the Flight Control Center, but that directly from space we were observing the very responsible moment in the docking of two artificial celestial bodies. Our own planet can be seen somewhere below, beneath the torn veil of the rapidly running clouds.

The television camera carried aboard the "Salyut-6" station creates such an illusion. The image transmitted by it is displayed here at the Center on an enormous screen by a TV apparatus. The large image makes it possible not only to see the docking in detail, but also to evaluate thoroughly the literally jewelerlike work of the crew and all the terrestrial services. The reckoning of the time involved in these operations is reckoned in seconds and distances in centimeters.

The beginning of the complex and precise computations was laid by the ballistics specialists long before the flight. Proceeding on the basis of these computations it was possible to set the launching time, the place and time of the docking. After the launching of the "Soyuz-26" its orbit was carefully checked and the electronic computers computed the operating regimes of the ship's engines in order to carry out orbital correction. Then the approach stage began. USSR Flier-Cosmonaut Hero of the Soviet Union V. Aksenov says:

"In essence all the maneuvers carried out in space during this flight period can be reduced to the task of reducing to zero the difference in the velocity and direction of movement of the ship and station by the time of the docking."

And now we hear the report of Yuriy Romanenko:

"There is contact! There is locking!"

The initial docking operations were carried out with enviable accuracy. Now we shift our eyes from the screen to the map of the world hanging alongside to convince ourselves that the earth has tracked the docking and has assisted it. The white trail of the orbit sweeps around the entire planet, intersecting the clear circles of the zones of radio visibility. The ground measuring stations and the ships located in different parts of the world ocean have literally linked the "Soyuz-26" and "Salyut-6" -- working hand-in-hand. They have monitored the actions of the cosmonauts and have assisted them with advice and encouraging words.

However, the reports of Yu. Romanenko and G. Grechko most frequently were accompanied by a brief commentary: "Everything is going normally!"

The reliability of the ground training of the crew and the careful preparation of the Flight Control Center had its fruits. The docking operation, beginning somewhere over the Atlantic, approached its completion somewhere over the Pacific Ocean. The docking lasted approximately four minutes. Then the leveling-out of the ship relative to the station began. The cosmonauts

successively checked the reliability of the mechanical joining of the two space vehicles, then the joining of the electric contacts, and finally, the tightness of the docking. And again brief reports were heard in the ether:

"Everything is going normally!"

The docking of the "Soyuz-26" was to the second docking unit, situated in the direction of the station's instrument compartment. The excellent training of Yu. Romanenko and G. Grechko was noted by the flight director, USSR Flier-Cosmonaut Twice Hero of the Soviet Union A. Yeliseyev:

"Technically the docking to the second unit differs little from operations with the first unit. To be sure, the cosmonauts experienced definite complexities of a psychological nature. But the crew acted reliably and calmly. The ground training and naturally, the experience of Georgiy Grechko, had their effect."

I would also like to note that the cosmonauts do not experience fatigue in their work. They are striving to save energy for the most responsible operations, cleverly distributing their energies. Yesterday, for example, they asked permission to increase the number of hours allocated to sleep at the expense of their personal time. And therefore by the time of the docking they were in good spirits and fresh.

Definite innovations also appeared in the ground support of the flight. For example, the scientific ship "Kosmonavt Vladislav Volkov" has gone on the active list. For the first time one floating tracking station has appeared in the Mediterranean Sea. This made it possible to increase the length of the radio contacts in the docking stage, and this means, the possibility of interaction between the Center and the cosmonauts.

At the time of entry into orbit the "Soyuz-26" was situated approximately 7,000 km from the "Salyut-6." And if they met precisely at the designated point and successfully docked, this means that the ballistics specialists, crew, Center and the entire command and measuring complex acted in unison and reliably.

From time to time comes the period for the next communications session. The earth gives permission for opening the transfer hatches. And then we hear:

"The first to enter the station after permission was granted was the ship's engineer."

And again at the Center the same screen was lit up. This time we see the working compartment of the station, with the transfer hatch turned toward us. First we note the light of a flashlight and then a smiling Georgiy Grechko floats up directly to the objective of the television camera. He

waves his hand in greetings and applause is heard at the Center in response. The cosmonaut as if hears this applause and smiling more broadly, says:

"I congratulate you on the beginning of work aboard the 'Salyut-6' station. Many thanks for the assistance."

"And thanks to you." "And we congratulate you in the name of all present," replies "Zarya."

The "Soyuz"- "Salyut" space complex has begun to operate. Grechko inspects the interior like a housekeeper. And it can be seen clearly how ample it is and how convenient it is for work and life. The ship's engineer is successively checking the operation of the instruments and then unexpectedly a head rises up before the camera:

"Is the television still working? Then let 'Taymyr' come here and we will both show you."

The earth gives permission and soon the commander and the ship's engineer embrace one another in the station interior. Once again there is applause in the Center hall: for manliness, skill and know-how of the crew. It can be seen clearly that the cosmonauts feel fine and are in a businesslike mood. And there is plenty for them to do ahead. There is much work to be done in the interests of science and the national economy. The Soviet program for the study and mastery of space for peaceful purposes is successfully continuing.

[126]

UPPER ATMOSPHERE, ON-BOARD SYSTEMS STUDIED

Moscow PRAVDA in Russian 29 Dec 77 p 1

[TASS Report] Flight Control Center. The orbital flight of cosmonauts Yuriy Romanenko and Georgiy Grechko on the manned "Salyut-6" station is continuing.

Yesterday the crew was granted a day of active rest. The cosmonauts put the station's compartments in order, systematized the results of conducted studies and experiments, exercised and rested.

Experiments were carried out in accordance with the program of geophysical research. In order to obtain data on the distribution of various components in the earth's atmosphere, the crew conducted observations of the upper layers of the atmosphere during the station's flight on the night side of the earth. The star Canopus was used as a luminous reference. The experiment was conducted as this star passed over the earth's horizon.

Today the working day on the station began, as usual, at 0800 hours. After breakfast and a medical check-up, the crew worked in accordance with the planned program. In the first half of the day the cosmonauts carried out a prophylactic operational check of individual on-board systems and assemblies. In particular, a study of the technical operation of the system that maintains the gas content of the station was conducted.

According to reports from orbit, the cosmonauts are in good health. On-board systems are functioning normally. The parameters of the microclimate in the compartments are being maintained within the prescribed limits. [5]

"SALYUT-6" CREW STUDIES GLACIERS

Moscow PRAVDA in Russian 30 Dec 77 p 6

[Article by V. Gubarev: "The Snows of Kilimanjaro"]

[Excerpt] In our country there is a service which constantly monitors the life of glaciers. Expeditions go into the mountains, conduct daily observations of them and predict the pulsation of their "tongues." But until recently glaciologists did not have such a splendid "observation tower" as the "Salyut-6" station.

"We consider Georgiy Grechko to be one of our specialists," says L. V. Desinov. "He thoroughly knows these problems. He visited the Nurekskaya Hydroelectric Power Station. First he flew in an aircraft, becoming familiar with glaciers and their peculiarities. When he passed over these regions a second time, Georgiy Mikhaylovich himself began to tell about the glaciers. This was a clear and reproachlessly precise analysis of a specialist who has good training in glaciology. And at a meeting where Grechko met with workers of the Nurekskaya Hydroelectric Power Station, he stated: "Now I am tracing the construction from space and observing the snow and ice conditions in your region."

At the request of UNESCO, Soviet scientists are preparing atlases of snow-ice resources of the planet. More than a tenth of the land is occupied by glaciers. These are gigantic storehouses of fresh water, fresh water which is in such short supply in many regions of the earth. Yuriy Romanenko and Georgiy Grechko are now involved in an inventory of this precious moisture.

"We can see the glaciers well from space," one hears from orbit. "Against a background of a brown-red surface they seem to be white caps on mountain giants..."

"All around there was much broken ice. The wind here evidently kept the area 'cleaned up'. Compression was reflected in the floe. In different places I noted fissures and high hummocks and ice mounds were formed

along the edges of the floe. This was young ice, cast up by compression onto our ice field."

The report of the "Salyut-6" crew and the record entered in the diary of I. D. Papanin in the North Pole region, are separated by 40 years. Four decades of the history of glaciology, Soviet science and our country.
[159]

"SALYUT-6" METEOR SENSORS

Moscow IZVESTIYA in Russian 29 Dec 77 p 2

[Article by B. Konovalov: "Reefs in Space"]

[Excerpt] The collision of a spaceship with a meteorite with the dimensions of a match box can end in catastrophe. Fortunately, the probability of such an undesirable encounter is exceedingly small. Small "dust specks" do not constitute a danger for the life of cosmonauts but can cause gradual erosion of the windows, semiconductor coatings of the solar cells and construction components of the station. Therefore, a study of the "dust" in circumterrestrial space is an important problem.

On the outside of the "Salyut-6" there are three sensors for measuring the intensity of incidence of meteor matter. Each of them has an area of 0.6 square meter. One of them is placed on the transfer section of the station near the front docking unit and two are on the surface of the main, work compartment. The first sensor is of the combined type, whereas the others are of the capacitor type. They constitute two charged plates of aluminum foil with a dacron intercalation between them. When a meteor particle penetrates the upper plate its ionized trail closes the capacitor and the signal is fed to a counter situated in the registry unit. With interrogation of the telemetric system the information is transmitted to the earth.

The most sensitive of the sensors registers dust particles weighing 10-12 g. It, like its colleagues, began to operate in an automatic regime immediately after the "Salyut-6" was put into orbit. The processed data indicate that the intensity of incidence of meteor particles is not constant. There may be from one to ten impacts per 100 revolutions. The larger the particle, the lesser is the probability of an encounter with it.

Now so-called sporadic meteor particles are being registered; their appearance has a random, unpredictable nature. But sometimes our planet in its path around the sun intersects streams of meteor particles. They have been studied quite well and the designers, in advance, on earth, prepare the orbital station for an encounter with these "space reefs." Most of the "Salyut" is protected by a special antimeteor shield. This is an envelope of vitreous textolite which is applied from the outside on top of the vacuum

screen insulation. In individual places this screen performs several functions. Being incident upon it, small meteor particles upon collision evaporate and the larger ones are fragmented into tiny pieces which are harmless for the main part of the ship.

In the investigation of the consequences of meteor bombardment a role was played by the cosmonauts after their arrival aboard the "Salyut-6." They are carrying out a regular examination of the station windows which are free of instrumentation in order to evaluate how they are bombarded with time, how their transparency changes. In the first inspection Romanenko and Grechko discovered that a bluish film is gradually formed on the window glass. And on one of the windows it was easy to see the trace of an encounter with a meteor particle -- the cosmonauts discovered a microcrater with a diameter of 1 1/2 millimeter. This was the first during the flights of manned ships and stations. It is true that on the first "Salyut" it appears that instruments registered the impact of a meteor particle on one of the lines of the heat-regulating system. The specialists, however, were not absolutely sure of this. But here was an obvious, clear trace.

[155]

Abstracts of Scientific Articles

VERTICAL SOUNDING OF IONOSPHERE IN ANTARCTICA

Leningrad INFORMATSIONNYY BYULLETEN' SOVETSKOY ANTARKTICHESKOY EKSPEDITSII
in Russian No 96, 1977 pp 46-53

[Abstract of article by I. A. Shumilov, Arctic and Antarctic Scientific Research Institute, "Vertical Sounding of the Ionosphere at the Molodezhnaya Aerometeorological Center"]

[Abstract] During the work of the 19th Antarctic Expedition an automatic ionospheric station for vertical sounding of the ionosphere was in operation. This article gives the results of vertical sounding of the E and F regions for the period May-November 1974. It appears that over Molodezhnaya particles can penetrate considerably deeper into the ionosphere than over Dikson Observatory in the Arctic and make an additional contribution to ionization of the D region and the lower part of the E region. Accordingly, the difference in the diurnal variations of median critical frequencies of the F2 and E_s layers can be attributed to the configuration of the earth's magnetic field. Comparison of the critical frequencies of the F2 and E_s layers at Molodezhnaya and Dikson indicated that the ionospheric data obtained in the high latitudes of the northern hemisphere cannot automatically be applied to the corresponding southern region. (At Molodezhnaya in the winter and at the equinox there was no nighttime F2 layer and daytime E_s layer; in November they were registered in the course of a 24-hour period. At Dikson the F2 and E_s layers were observed in the course of the day during all seasons of the year. The maximum median f_0F_2 values at Molodezhnaya were greater than at Dikson during the solstice period by 1.5-2 MHz and at the equinox (September) by 0.5 MHz. The maximum median f_0E_s values at Molodezhnaya are greater than at Dikson in winter (July) by 0.4 MHz, and in spring (September) by 2.7 MHz.)

[123]

IV. MISCELLANEOUS

News

"MIKHAIL SOMOV" BEGINS CRUISE TO ANTARCTIC

Moscow PRAVDA in Russian 30 Dec 77 p 3

[Unsigned article: "To the Ice Continent"]

[Text] Leningrad. The scientific research vessel "Mikhail Somov" has begun its third cruise to the shores of the Antarctic.

On board the diesel-electric ship are participants in the 23d Soviet Antarctic Expedition. The ship will stop at the Molodezhnaya and Leningradskaya stations and at Mirnyy Observatory, where polar researchers will be changed and supplies of fuel and provisions will be replenished. En route to the ice continent specialists will conduct a series of hydrological measurements and meteorological observations. [5]

Abstracts of Scientific Articles

DETAILED SUMMARY OF NINETEENTH SOVIET ANTARCTIC EXPEDITION

Leningrad INFORMATSIONNY BYULLETEN' SOVETSKOY ANTARKTICHESKOY EKSPEDITSII in Russian No 96, 1977 pp 5-12

[Abstract of article by V. S. Ignatov, Arctic and Antarctic Scientific Research Institute, "Principal Results of Work of the Nineteenth Wintering Soviet Antarctic Expedition"]

[Abstract] Weathermen at Molodezhnaya, applying the macrocirculation method, for the first time in Antarctica organized an experimental comparison of three-day weather forecasts for a number of regions in the southern hemisphere using an electronic computer to compute the surface and high-level fields of pressure, geopotential and some other characteristics of synoptic processes. Meteorological rockets of a new type were launched. Work

has continued and there has been a considerable broadening of work on the automation of scientific observations, collection and machine processing of the arriving information. During the 19th expedition all Soviet Antarctic stations began to use "Minsk-32" computers. Among the different kinds of work on automation of scientific observations, at Molodezhnaya there is now an automatic hydrometeorological station designed for measuring, processing and registering the principal meteorological elements on teletype paper and punched tape. A new automatic actinometric apparatus is in use on an experimental basis. On a profile of eight hydrological stations laid out on the shore ice it was possible to study the hydrological regime of the shore waters in Alasheyev Gulf, the processes of formation, development and destruction of shore ice. Vertical sounding of the ionosphere was organized at Molodezhnaya for the first time. All Soviet Antarctic stations carried out a great complex of biomedical research for study of the mechanisms of human adaptation to the extremal conditions prevailing in Antarctica. Studies were made of the biochemistry and biophysics of human energy, heat regulation, diurnal and seasonal rhythms of physiological functions, trace elements in the hair and nails for an evaluation of regenerative processes, water-salt metabolism, etc. At Mirnyy for the first time studies were made of tooth pathology. At Leningradskaya station a study was made of the characteristics of human physical activity under extremal Antarctic conditions, its influence on changes in the motor system, and also in the diurnal and seasonal rhythm of the cardiovascular and sympathico-adrenal systems. On Waterloo Island biologists studied the annual biological cycle of life of Antarctic seals of the South Shetland Islands. At Vostok specialists developed new methods for deep drilling of ice boreholes at low temperatures (below -50°C). Artificial earth satellites were observed and at Molodezhnaya and Leningradskaya data were received from American meteorological satellites. These data have been used in determining the position of pressure centers, their evolution and destruction, in making a frontal analysis of the synoptic situation, in evaluating the state of the cloud cover and ice conditions, in discovering the field of fog and the movement of icebergs. [Details are given concerning these investigations and a series of other undertakings.]

[123]

5303

-END-

CSO: 1866